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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/051,228	01/22/2002	Thomas Alan Taylor	CS-21182	7993
27182	7590	09/22/2004	EXAMINER	
PRAXAIR, INC. LAW DEPARTMENT - M1 557 39 OLD RIDGEBURY ROAD DANBURY, CT 06810-5113			MCNEIL, JENNIFER C	
			ART UNIT	PAPER NUMBER
			1775	

DATE MAILED: 09/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

S.C.

Office Action Summary	Application No. 10/051,228	Applicant(s) TAYLOR ET AL	
	Examiner Jennifer C McNeil	Art Unit 1775	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 June 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-6,9-15,17-22,24-28,33 and 38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,9-13,17-22,24-28,33 and 38 is/are rejected.
- 7) ☒ Claim(s) 5,6,14 and 15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 16, 2004 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3, 4, 9-13, 17-25, 27-30, 32-35, 37, and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,073,433) in view of Graham et al (US 6,432,487). Taylor teaches a thermal barrier coating for a metal substrate. The thermal barrier coating comprises zirconia stabilized with yttria with a density greater than 88% and a plurality of macrocracks homogeneously dispersed throughout the coating to improve its thermal fatigue resistance. Taylor does not teach an additional coating thereon that does not include macrocracks. Graham teaches that dense vertically cracked zirconia layers are too dense to abrade and provides a sacrificial layer on the dense layer that is easier to remove and serves as an indicator to operators for thickness limits. Both Graham and Taylor teach that the coatings are used in turbine engine components. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide a sacrificial layer such as that of Graham, on the

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vertically cracked layer of Taylor to provide an indicator during use that the coating is reaching its thickness limits.

Regarding claims 3, 9, 10, 12, 17 and 18, Taylor teaches that horizontal microcracks may also be present, and may be 5-25 % of the average length of the vertical cracks.

Regarding claims 4 and 13, Taylor teaches that the macrocracked layer may be applied by multiple monolayers, each having cracks.

Regarding the number of microcracks, Taylor teaches that there are at least 20 vertical macrocracks per linear inch, which converts to 50 per linear centimeter.

Regarding claims 19-21, while Graham does not teach the density of the outer layer, it is clearly stated that the outer zirconia layer is less dense and is purposefully softer and easier to abrade. It would have been obvious to one of ordinary skill to form the outer layer with a density sufficient to allow increased softness and abrasability.

Regarding claims 22 and 23, it would have been obvious to one of ordinary skill to provide the layers at a thickness that would provide the desired corrosion resistance to the underlying substrate.

Regarding claim 24, the zirconia may be stabilized by yttria.

Regarding claim 25, Taylor teaches the use of a bond coat between the substrate and the coating.

Claim 27 is considered a method limitation for an article and is not considered to structurally define over the prior art.

Regarding claims 29, 30, 32, 34, 35, and 37 Taylor teaches that the coating may be used for turbine engine seals.

Claims 1, 3, 4, 9-13, 17-25, 27-30, 32-35, 37, and 39 rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,073,433) in view of Good et al (US 6,358,002). Taylor teaches a thermal barrier coating for a metal substrate, such as a turbine engine seal. The thermal barrier coating comprises zirconia stabilized with yttria with a density greater than 88% and a plurality of macrocracks

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homogeneously dispersed throughout the coating to improve its thermal fatigue resistance. Taylor does not teach an additional coating thereon that does not include macrocracks. Good teaches an air seal used in a gas turbine engine comprising a substrate, a dense erosion resistant ceramic layer applied over a bond coat, and an abradable ceramic layer applied over the dense ceramic layer. The dense ceramic layer is applied such that microcracks form in and extend generally through the dense ceramic layer. Good teaches that the abradable coating provides good sealing between the blades and the seals and the underlying layer of dense ceramic material provides enhanced erosion resistance and durability in addition to the thermal insulating capability of the ceramic material. The abradable material of Good is applied over the portion of the seal that interacts with the rotating turbine blades. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide an abradable material layer such as that taught by Good on a dense cracked ceramic material as taught by Taylor to provide a seal having abradable material only where the seal cooperates with the mating component, good sealing between the blade and the seal, as well as enhanced erosion resistance and durability.

Regarding claims 3, 9, 10, 12, 17 and 18, Taylor teaches that horizontal microcracks may also be present, and may be 5-25 % of the average length of the vertical cracks.

Regarding claims 4 and 13, Taylor teaches that the macrocracked layer may be applied by multiple monolayers, each having cracks.

Regarding the number of microcracks, Taylor teaches that there are at least 20 vertical macrocracks per linear inch, which converts to 50 per linear centimeter.

Regarding claims 19-21, while Good does not teach the density of the outer layer, it is clear that the outer zirconia layer is less dense and is purposefully softer and easier to abrade. It would have been obvious to one of ordinary skill to form the outer layer with a density sufficient to allow increased softness and abradability.

Regarding claims 22 and 23, it would have been obvious to one of ordinary skill to provide the layers at a thickness that would provide the desired corrosion resistance to the underlying substrate.

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Regarding claim 24, the zirconia may be stabilized by yttria.

Regarding claim 25, Taylor teaches the use of a bond coat between the substrate and the coating.

Claim 27 is considered a method limitation for an article and is not considered to structurally define over the prior art.

Regarding claims 29, 30, 32, 34, 35, and 37 Taylor teaches that the coating may be used for turbine engine seals.

Claim 26 is rejected under U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,073,433) and Graham et al (US 6,432,487), as applied to claim 25 above, and further in view of Gupta et al (US 5,403,669). Please refer to the previous office action for the text of the rejection.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,073,433) and Good et al (US 6,358,002 as applied to claim 25 above, and further in view of Gupta et al (US 5,403,669). Taylor and Good as combined above teach a turbine component with a vertically macrocracked layer and a sacrificial layer thereon. As taught by Taylor, a bond coat may be used between the substrate and the coating, but does not address the surface roughness of the bond coat. Gupta teaches a thermal barrier coating of a ceramic on a metal substrate. The ceramic coating may be zirconia, and is attached via a bond coat. The bond coat is applied with a surface roughness of 200-600 microinches, and serves as an anchor for the ceramic coating, which results in an article with resistance to spalling of the coating from underlying portions of the coating system. As it is taught by Gupta, that a bond coat with a roughened surface serves to improve the resistance to spalling of the ceramic layer, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a roughened surface to the bond coat of Taylor to improve the spalling resistance of the overlying ceramic layer.

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Allowable Subject Matter

Claims 5, 6, 14, and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

Applicant amended the independent claims to include the limitations of a tip-to-seal ratio of 0.1 or less, a thickness of at least about 0.2 mm, and cyclic thermal shock resistance up to a temperature of at least about 2500 degrees Fahrenheit.

While Taylor, Graham, and Good do not specifically address a tip-to-seal ratio, as the coatings are made of similar material, and have thicknesses similar to that of the instant claims, the characteristics are expected to also be commensurate.

The thickness of the coating of Graham is greater than 0.2mm and is fully expected to have a cyclic thermal shock resistance up to at least 2500 degrees Fahrenheit.

The thickness of the coating of Good is also greater than 0.2mm and is fully expected to have a cyclic thermal shock resistance up to at least 2500 degrees Fahrenheit.

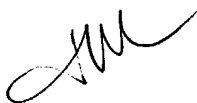
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer C McNeil whose telephone number is 571-272-1540. The examiner can normally be reached on 9AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Deborah Jones can be reached on 571-272-1535. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jennifer McNeil
Primary Examiner